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09/528,253	03/17/2000	Kaori Fujimura	10746/17	4420

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EXAMINER

AKHAVANNIK, HUSSEIN

ART UNIT	PAPER NUMBER
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2621

DATE MAILED: 06/02/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/528,253

Applicant(s)

FUJIMURA ET AL.

Examiner

Hussein Akhavannik

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-10, 12-26, 28, 29, 31-38 and 40-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3 and 33 is/are allowed.
- 6) ☒ Claim(s) 1-2, 4, 6-10, 12-26, 28, 29, 31-32, 34-38 and 40-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 March 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Amendment***

1. The Applicant's amendment to the specification and the claims overcome the examiner's objections cited in paragraphs 1-3 of the previous office action.

### ***Response to Arguments***

2. Applicant's arguments filed 3/24/2003 have been fully considered but they are not persuasive.

Applicant alleges that the Xu et al is directed towards a two-dimensional comparison of two section images and not two projection images as called for in claims 1, 24, and 31.

Examiner respectfully disagrees. The Applicant points to figures 1A-2C and page 20 of the application to illustrate and explain projection images. These images correspond exactly to the section images which Xu et al use to determine shift amounts, as illustrated by Xu et al in figures 2A-2B, 4A-4F, and 6A-6C. Both the section images of Xu et al and the projection images of the Applicant correspond to images of the lung taken perpendicularly to the z-axis, which runs parallel to the backbone. Furthermore, Xu et al explain in column 6, lines 32-36 that the section images may be used to determine shifts in the z-axis direction. Xu et al also illustrate in figure 6C that two section images being compared to each other to determine shift amounts in the X and Y direction. Therefore, Xu et al is concerned with using section images, which correspond exactly to the claimed "projection" images, to determine the shifts between two images taken at different times.

Applicant alleges on page 19-20 of the amendment (now Paper No. 9) that the motivation to combine references in the 35 U.S.C. 103 rejections made by the examiner lack proper

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motivation. The applicant does not refer to any specific claim or feature. Examiner respectfully disagrees. For example, in the 35 U.S.C. 103 rejections of claims 2, 6, 25, 28, 32, and 34, the examiner explains that aligning the resolutions of the first tomographic images and the second tomographic images by scaling one or both of the tomographic images when the resolutions of the tomographic images are different would have been obvious to one of ordinary skill in the art at the time the invention was made in view of the enlarging or reducing of images done by Some et al in column 13, lines 39-61. Some et al perform the magnification correction (200) before performing the template matching (202) between a first image and a second image to find a region of interest, as illustrated in figure 6. A magnification correction would be necessary to improve the probability of finding a template of a certain resolution in another image, which could be at a different resolution. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to align the resolution of the first and second tomographic images by scaling the one or both of the images so that the probability of detecting the template in a second image is increased resulting in more accurate shift measurements. The applicant is reminded of 37 C.F.R. 1.111(b) which requires that the Applicant's reply "distinctly and specifically point out the supposed errors in the examiner's action" and "specifically point out how the language of the claims patentably distinguishes them from the references."

Applicant argues further that the references relied upon do not teach the means to perform the claimed function in the claims having means-plus-function language. Again, this takes the form of a general allegation without reference to specific claims and specific features. Examiner respectfully disagrees. Referring to claim 24, for example, the means to perform all the claims functions are illustrated by Xu et al in figure 14. Xu et al illustrated all the circuits

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required to process and align section (or projection) images and the examiner has done his best to map the reference into the claimed features.

***Allowable Subject Matter***

3. Claims 3 and 33 are allowed.

4. The following is a statement of reasons for the indication of allowable subject matter:

The prior art fails to teach or suggest the features of providing n different channels for a signal x which has  $128 * n$  stages in context of the position correction of a projection image recited in the independent claims 3 and 33.

***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 11 recites the limitation "said template area" in claim 23. There is insufficient antecedent basis for this limitation in the claim as claim 11 has been canceled.

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined

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was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

8. Claims 1, 24, and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu et al (U.S. Patent No. 6,363,163).

As applied to claim 1, which is representative of claims 24 and 31,

- i. Inputting first tomographic images and second tomographic images is explained by Xu et al in column 4, lines 58-66. The sets of data are obtained through tomography scans and are taken at different times.
- ii. Generating a first projection image from the first projection images and a second projection image from the second tomographic images is illustrated by Xu et al in figures 2A-2B. These projection images are generated from the tomographic images input by Xu et al. These section images are also perpendicular to the z-axis as the section each part of the lung in the y-axis plane.
- iii. Measuring the shift amount between the first projection image and a second projection image by searching the second for the same area as a template generated from the first projection image is explained by Xu et al in column 7, lines 35-52 and illustrated in figure 6C for the X-axis and Y-axis correction and column 6, lines 27-52 for the Z-axis direction . The use of a template from the first projection data is explained by Xu et al in column 7, line 63 to column 8, line 9, the claimed template corresponding to Xu et al's "previous section image" and

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the claimed shift amount corresponding to Xu et al's  $\Delta X$  and  $\Delta Y$  at column 8, lines 6 and 36.

iv. Correcting the slice position according to the shift amount between the first projection image and the second projection image is explained by Xu et al in column 8, lines 44-64.

v. Displaying the diagnostic image and the comparison image at a corrected slice position is explained by Xu et al is illustrated by Xu et al in figure 13 as the output device (105). Xu et al explain that this device could be a display in column 10, lines 30-32. The display is apparent as well in Xu's drawings. For example, see figures 2A-2B and 6A-6C.

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Some et al (U.S. Patent No 5,841,148).

Referring to claims 2, 6, 25, 28, 32, and 34, all the limitations of these claims correspond to claim 1, except:

i. Aligning the resolutions of the first tomographic images and the second tomographic images by scaling one or both of the tomographic images when the

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resolutions of the tomographic images are different is not explained by Xu et al. However, Some et al do explain an image processing apparatus to enlarge or reduce images in column 13, lines 39-61. Some et al perform the magnification correction (200) before performing the template matching (202) between a first image and a second image to find a region of interest, as illustrated in figure 6. A magnification correction would be necessary to improve the probability of finding a template of a certain resolution in another image, which could be at a different resolution. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to align the resolution of the first and second tomographic images by scaling the one or both of the images when the resolutions of the two images are different so that the probability of detecting the template in a second image is increased resulting in more accurate shift measurements.

ii. Measuring the shift amount between the first projection image and a second projection image by searching the second for the same area as a template generated from the first projection image by pattern matching while shifting the template by an interval is explained by Xu et al in column 7, lines 35-52 for the X-axis and Y-axis correction and column 6, lines 27-52 for the Z-axis direction. The use of a template from the first projection data and using cross-correlation matching to find the highest correlation point between the template and the second image group is explained by Xu et al in column 7, line 63 to column 8, line 9.



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Referring to claims 4, 10, 26, 29, and 38, all of the limitations of these claims correspond to claims 2, 6, 25, 28, 32, and 34, except:

- i. Generating a first projection image of the X axial direction from the first tomographic images and generating a second projection image from the second tomographic images is explained by Xu et al in column 5, lines 1-7. The reconstructed tomographic data is three-dimensional so it may be reconstructed in the X, Y, or Z axial direction. Once the data is reconstructed, then projection (or section) images may be taken in any direction as illustrated by Xu et al in figures 2A-2B for the Y-axis.

Referring to claims 16, 17, 44, and 45, generating the projection images in which a weight is assigned to the specific observation object by setting a window level and a window width is not explicitly explained by Xu et al. However, Some et al do explain an image data selection unit (68) that is capable of selecting a part of image data stored in memory in column 9, line 53 to column 10, line 20. This selected image data can then be processed for magnification correction and then position correction. By selecting only a portion of the projection image in memory, Some et al are assigning a weight of one to the selected window and a weight of zero to the addition portions of the image. By selecting only a portion of the projection image, computation necessary for position correction can be reduced. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a window of the projection image by assigning weights to the original projection image.

Referring to claims 18, 19, 46, and 47, generating the projection images in which only a part including the distinctive part is projected is not explicitly explained by Xu et al. However,

Some et al do illustrate projection images in which only the distinctive part is included in figure

4. By selecting only the distinctive part of the projection image, computation necessary for position correction can be reduced while the result of the template search would not suffer.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image in which only the distinctive part is projected to reduce computation time and/or processing power.

Referring to claims 50-54, finding a reference position in the Y-axial direction from the first and second tomographic image and correcting the shift in the Y axial direction on the basis of the reference position is illustrated by Xu et al in figure 6C. The reference position are illustrated in figure 4A and explained in column 7, lines 1-14 as the regions of interest, which are clearly in the Y-axial direction.

11. Claims 7-8, 12, 35-36, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Some et al as applied to claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 above, and further in view of Moshfeghi (U.S. Patent No. 5,368,033).

Referring to claims 7 and 35, generating the projection image comprising of pixel values obtained by adding pixel values obtained by adding pixel values of the tomographic images in the X or Y axial direction or in any other direction is not explicitly explained by the system of Xu et al and Some et al. However, Moshfeghi does explain generating projection images of a blood vessel by summing the intensities of the voxels (three-dimensional pixels) in the viewing direction in column 9, lines 14-26 and illustrated in figure 2. The images of the blood vessel in figure 2 are obtained tomographic magnetic resonance techniques, which are analogous to the CT scanning of this application. The projection image created by Moshfeghi illustrates the

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thickness and overlap of the vessels that have been imaged. Such information would be obvious to use in the system of Xu et al and Some et al to better define the reference positions used to align the two projection images. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to create a projection image by adding pixel values of tomographic images in any direction so that the reference positions used to determine the shift amounts are better defined.

Referring to claims 8, 12, 36, and 40, all the limitations of this claim correspond to claim 7, except:

- i. Generating a projection image by interpolating the two-dimensional image is not explicitly explained by the system of Xu et al and Some et al. However, Moshfeghi explains interpolating images to create projection images in column 9, lines 14-26. Moshfeghi explains that interpolating the images would be beneficial when the parallel rays do not pass precisely through the center of the voxels to resample the volumetric image to determine new voxel centers. Therefore, the interpolation would align the parallel slice image sequence to create an accurate projection image. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image by interpolating a two-dimensional image sequence so that the projection images are created more accurately, resulting in a more accurate shift measurement.

12. Claims 9, 22, 23, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Some et al as applied to claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 above, and further in view of Jang et al (U.S. Patent No. 5,862,249).

Referring to claims 9, 22, 23, and 37, the template being an area of 25% to 50 % from the top of the first projection image in the Z axial direction is not explained by the system of Xu et al and Some et al. However, Jang et al do illustrate four horizontal strip regions that are used to extract certain features from in figure 7a. Jang et al explain that the regions Rh3 and Rh4 have the same width and regions Rh1 and Rh2 have the same width in column 6, line 63 to column 7, line 4. Therefore, by setting the widths of the four regions equal to each other is would be possible to use an area 25% to 50% from the top of the first projection in the X axial direction as the template. The system of Jang et al then performs position correction similar to the system of Xu et al and Some et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a template to be an area 25% to 50% from the top of the first projection image in the Z axial direction to reduce the computation necessary to search for a template.

13. Claims 13-15, 20-21, 41-43, and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Some et al as applied to claims 2, 4, 6; 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 above, and further in view of Kano et al (U.S. Patent No. 5,359,513).

Referring to claims 13 and 41,

- i. Extracting a bed area as the reference position from the first tomographic image and second tomographic image in not explained by the system of Xu et al and Some et al. However, Kano et al do explain using the mediastinum as a region of interest to align to images in column 6, lines 12-19. Kano et al go on explain that the mediastinum is the white area near the center of the chest due to

the spine and other related anatomical structures. The spine is surrounded by the backbone, so it would be included as part of the mediastinum according to the definition of Kano et al. The mediastinum is located in the bed area, as it has been imaged. Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to use the bed area as the reference position from the first tomographic image.

ii. Correcting the shift in the Y axial direction on the basis of the bed surface, the Y-axis being perpendicular to the bed surface is not explained by the system of Xu et al and Some et al. However, Kano et al explain calculating the shift of an image in the Y axial direction in column 9, lines 14-26 and illustrate the calculation in figure 5. In figure 5, the Y axial direction is perpendicular to the surface of the bed when the patient is lying on his/her back. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to correct the shift in the Y axial direction on the basis of the bed surface.

Referring to claims 14 and 42, these claims correspond to claims 13 and 41. The mediastinum includes the backbone and spine, which are both body parts.

Referring to claims 15 and 43, these claims correspond to claims 13 and 41. The mediastinum includes the backbone.

Referring to claims 20, 21, 48, and 49,

Generating a plurality of templates and performing template matching on the second image by the plurality of templates is not explained by the system of Xu et al and Some et al. However, Kano et al do explain warping a second image on

the basis of local matching of a number of small regions of interest in column 5, line 60 to column 6, line 19. . Measuring the shift amount between the first projection image and the second projection image from a plurality of reference points is explained by Kano et al in column 9, lines 14-26. It would be beneficial to use multiple templates (or ROIs) to improve the accuracy of the alignment between the first and second projection image. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use multiple templates to correct the alignment between two projection images.

***Conclusion***

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hussein Akhavannik whose telephone number is (703)306-4049. The examiner can normally be reached on M-F 8:30-5:00.

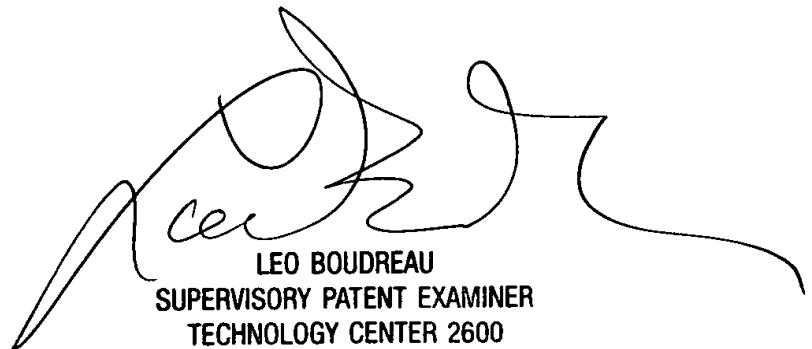
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on (703)305-4706. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9314 for regular communications and (703)872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)305-3900.

Hussein Akhavannik  
May 29, 2003

H.A.



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